

## CLAIMS:

1. An inserting and extracting device for rotatable data carrier plates which mechanically moves the data carrier plate (1) from an inserting position into a playing position before playing and back into the inserting position again after playing, with parallel guide rails (2) which extend over the full range of movement for insertion and extraction and  
5 which guide the data carrier plate (1) in grooves (5) at diagonally mutually opposed edge regions, wherein at least one of the guide rails (2) transmits to the data carrier plate (1) motion pulses in one of its directions of movement, by means of which pulses the data carrier plate (1) is moved in the insertion or extraction direction.
- 10 2. An inserting and extracting device as claimed in claim 1, characterized in that the motion pulses are exerted on one or both of the guide rails (2) by means of a piezoelectric drive (100).
3. An inserting and extracting device as claimed in claim 2, characterized in that  
15 the piezoelectric drive is formed by piezomotors (100), each of which exerts an impact force on one guide rail (2).
4. An inserting and extracting device as claimed in claim 1, characterized in that  
20 each guide rail (2) itself is a piezomotor (10) comprising a stator (13) provided with stator teeth (15) and a piezoelectric element (17) whose active cell (11) serving for driving has a length of at least one half wavelength.
5. An inserting and extracting device as claimed in claim 4, characterized in that  
25 only one guide rail (2) is itself a piezomotor comprising a stator (13) provided with stator teeth (15) and a piezoelectric element (17) whose active, exciting cell (11) has a length of at least one half of a wavelength or an integer multiple of one half of a wavelength.
6. An inserting and extracting device as claimed in claim 4, characterized in that each guide rail (2) itself is a piezomotor (10) comprising a stator (13) provided with stator

teeth (15) and a piezoelectric element (17), wherein the length of the exciting part corresponds to two wavelengths.

7. An inserting and extracting device as claimed in claim 4, characterized in that the piezoelectric element (17) of the motor (10) is formed by a piezoelectric ceramic material (18) which has regions of alternating polarity with a length of half a wavelength ( $\lambda/2$ ), while covering electrodes (19, 21) are provided, of which one electrode (19) adjoining the stator (13) extends over the full length of the ceramic material (18), and electrodes (21) having a length of  $\lambda/4$  and situated at the other side of the ceramic material (18) are alternately connected to terminals (22, 23) of alternating polarity.

8. An inserting and extracting device as claimed in claim 4, characterized in that only those regions of a piezomotor (10) for one direction of movement which are covered by the associated control electrodes (19, 21) are made from piezoceramic material.

9. An inserting and extracting device as claimed in claim 4, characterized in that the stator (13) for one impact direction is prolonged in longitudinal direction over and beyond the piezoelectric element (17) by means of extensions (28) to an amount of an odd multiple of  $\lambda/4$ .

10. An inserting and extracting device as claimed in claim 4, characterized in that the stator (13) for an opposed impact direction is prolonged in longitudinal direction over and beyond the piezoelectric element (17) by means of extensions (29) to an amount of an even multiple of  $\lambda/4$ .

11. An inserting and extracting device as claimed in claim 4, characterized in that the minimum length of the active cell (11) and additional stator material (28, 29) corresponds to at least one wavelength  $\lambda$ .

12. An inserting and extracting device as claimed in claim 4, characterized in that the exciting portion of the stator (13) is prolonged by odd multiples of one fourth of a wavelength ( $\lambda/4$ ) on one half of the guide rail (2) and by even multiples of  $\lambda/4$  on the other half.

13. An inserting and extracting device as claimed in claim 12, characterized in that the two halves of the guide rails (2) are decoupled from one another by means of blade springs at the level of the neutral oscillation line.

- 5 14. An inserting and extracting device as claimed in claim 4, characterized in that the resonance frequency  $F_i$  of the motor is expressed by

$$F_i = \frac{((i + 1/2) \cdot \pi)^2}{\sqrt{12}} \cdot h / l^2 \cdot \sqrt{E / \rho}$$

10 in which  $i$  by first approximation is dependent on the order of the standing wave  $I$ , on the length  $l$  of the stator, on the height  $h$  of the stator, on the material constant, on the elasticity module  $E$ , and on the density  $\rho$  of the stator material.

- 15 15. An inserting and extracting device as claimed in claim 4, characterized in that the stator teeth (15) are arranged at distances of  $\lambda/2$  in locations between the antinodes (26) and nodes (25) formed in the oscillation.

- 20 16. An inserting and extracting device as claimed in claim 3, characterized in that the motor (10) has approximately the length of the path of movement of the data carrier plate (1).

- 25 17. An inserting and extracting device as claimed in claim 4, characterized in that the stator teeth (15) are provided with grooves (5) in longitudinal direction of the piezomotor (10), into which grooves (5) the data carrier plate (1) enters with its edge (3).

18. An inserting and extracting device as claimed in claim 1, characterized in that the motion pulses are transmitted to the respective guide rail (2, 41) and through the latter to the data carrier plate (1) by means of an eccentric mechanism (34, 42).

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19. An inserting and extracting device as claimed in claim 18, characterized in that the eccentric mechanism (34) causes the guide rail (2) propelled by said eccentric mechanism (34) to oscillate about a center of rotation (31), and the oscillations of the guide rail (2) impart to the data carrier plate (1) a forward pulse in the motion direction (6).

20. An inserting and extracting device as claimed in claim 18, characterized in that the eccentric mechanism (42) transmits oscillation pulses to a belt conveyor (41), which transmits said pulses as driving pulses to the data carrier plate (1).

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21. An inserting and extracting device as claimed in claim 20, characterized in that the belt conveyor (41) moves the data carrier plate (1) in the insertion or extraction direction in accordance with the direction of its circulatory movement.

10 22. An inserting and extracting device as claimed in claim 20, characterized in that the belt conveyor (41) has a grooved profile (46) with which the edge (3) of the data carrier plate (1) comes into engagement.

15 23. A piezoelectric motor as claimed in claim 4 for providing the linear movement of components to be moved by means of impact pulses.